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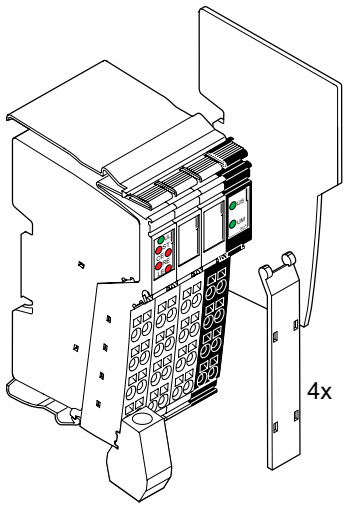
IB IL 24 MUX MA (-PAC)

Inline field multiplexer



AUTOMATION

Data sheet
5985_en_06

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1 Description

The field multiplexer is the central unit of a field multiplexer station. All Inline I/O terminals are connected to it. The field multiplexer exchanges data with the opposite station via a remote bus cable.

Features

- Remote bus connections in copper technology (can be operated via fiber optics using an interface converter)
- Can supply a field multiplexer station with all of the required 24 V voltages
- Floating alarm output ("N/C" relay contact) for connecting alarm signals
- Connection establishment and comparison of the I/O configuration of both stations
- Diagnostic indications via LEDs
- Hardware version 15 or later:
  Approved for use in zone 2 potentially explosive areas (observe the notes on page 9)

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This data sheet is only valid in association with the IL SYS INST UM E user manual.

Please refer to the IB IL MUX UM E user manual for further information on the field multiplexer.

You will find a list of I/O terminals that can be operated on the field multiplexer in the AH IL BK IO LIST application note. See "Ordering data" on page 2.

Make sure you always use the latest documentation.
It can be downloaded at www.download.phoenixcontact.com.

This data sheet is valid for the products listed on the following page:

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2 Ordering data

Products

Description	Type	Order No.	Pcs./Pkt.
Field multiplexer, complete with accessories (connectors and labeling fields)	IB IL 24 MUX MA-PAC	2861205	1
Field multiplexer, without accessories	IB IL 24 MUX MA	2718413	1

The listed connector set is needed for the complete fitting of the IB IL 24 MUX MA.

Accessories

Description	Type	Order No.	Pcs./Pkt.
Connector set for the field multiplexer	IB IL MUX-PLSET	2836036	1
Keying profile	CP-MSTB see COMBICON catalog	1734634	100
Zack marker strip to label the terminals	ZBF 6 ... see CLIPLINE catalog ZBF 12 ... see CLIPLINE catalog		
DIN EN 50022 DIN rail, 2 meters	NS 35/7,5 PERFORATED NS 35/7,5 UNPERFORATED	0801733 0801681	1 1
Standard end clamp; snapped on without tools	CLIPFIX 35-5	3022276	50
End clamp for use in the event of vibrations or installation on vertical DIN rail; secured with screws	E/AL-NS 35	1201662	50
Adapter cable between field multiplexer and PSI interface converter	IB IL MUX-CAB PSI	2878476	1

Accessories: Additional system components

Description	Type	Order No.	Pcs./Pkt.
Surge protection for protection of the remote bus cable, the power supply units, and the entire control cabinet by fuses	See TRABTECH catalog		
Fiber optic interface converters for fiber optic data transmission	See INTERFACE catalog		
Temperature measuring transducer to acquire temperature values	See INTERFACE catalog		
Power supply units to supply the field multiplexer stations	See INTERFACE catalog		
End clamps, grounding clamps, and shield connection clamps	See CLIPLINE catalog		
Cables suitable for copper or fiber optic transmission	See INTERFACE or AUTOMATION catalog		

Documentation

Description	Type	Order No.	Pcs./Pkt.
"Automation terminals of the Inline product range" user manual	IL SYS INST UM E	2698737	1
"Configuring and installing the Inline field multiplexer" user manual	IB IL MUX UM E	2718439	1
"Summary of key data for Inline devices" data sheet	DB GB IB IL DEVICE LIST	9007007	1
"I/O modules at bus couplers“ application note	AH IL BK IO LIST	9015358	1
"Inline terminals for use in zone 2 potentially explosive areas" application note	AH EN IL EX ZONE 2	–	–

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3 Technical data

General data	
Housing dimensions (width x height x depth)	48.6 mm x 136 mm x 72 mm (with connector set)
Weight	146 g (without connectors), 212 g (with connectors)
Ambient temperature (operation)	-25°C to 55°C
Ambient temperature (storage)	-25°C to +85°C
Humidity (operation/storage/transport)	10% to 95% according to EN 61131-2
Air pressure (operation/storage/transport)	70 kPa to 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Degree of protection	Class 3 according to EN 61131-2, IEC 61131-2
Housing material	Basic material: ARNITE plastic PA6.6, self-extinguishing (V0)
Pollution degree according to EN 50178	2; condensation not permitted during operation
Surge voltage class	II (low-level signal)
Connection data for Inline connectors	
Connection method	Spring-cage terminals
Conductor cross-section	0.08 mm^2 to 1.5 mm^2 (solid or stranded), 28 - 16 AWG

System data	
Number of devices per station	63, maximum
Number of I/O points per station	512 digital or 32 analog I/Os, maximum, can be mixed
Update time for all inputs/outputs	1 s, maximum
Maximum field multiplexer current for supplying the logic of I/O terminals	2 A at U_L
Maximum additional current for supplying the analog terminals	0.5 A at U_{ANA}

Common data for 24 V main supply, segment supply, and field multiplexer supply	
Connection	Through Inline connector; terminal point assignment see page 7
Connection method	Spring-cage terminals
Recommended cable lengths	30 m, maximum; routing cables through outdoor areas is not admissible
Continuation	Via potential routing
Special demands on the power supply	The field multiplexer supply U_{MUX} is electrically isolated from U_M/U_S if it is supplied separately. This is only ensured if two separate power supplies are used.
Nominal value	24 V DC
Ripple	± 5%
Permissible range	19.2 V to 30 V (ripple included)

NOTE: Module damage due to overload

Each 24 V area must be protected externally. The power supply unit must be able to supply 4 times (400%) the nominal current of the external fuse, to ensure that the fuse blows safely in the event of an error.

Observe the current consumption of every device on the individual potential jumpers when configuring a field multiplexer station. It is specified in every terminal-specific data sheet. The current consumption can differ depending on the individual terminal. If the maximum current carrying capacity of a potential jumper is reached, a new power terminal must be used.

24 V main supply (U_M)/24 V segment supply (U_S)	
Current carrying capacity	8 A, maximum

WARNING: Explosion hazard, restrictions regarding the Inline system

When using the terminal in potentially explosive areas, observe the limitations on the current carrying capacity (see "Notes on using the terminal in potentially explosive areas" on page 9).

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24 V field multiplexer supply (U_{MUX})

Current consumption at U_{MUX}	
Minimum current consumption at nominal voltage	60 mA (no local bus devices connected)
Maximum current consumption at nominal voltage	1,25 A

Consisting of

0.060 A	Current consumption of field multiplexer, electronics
+ 0.690 A	Communications power for all I/O terminals
+ 0.5 A	Supply for the analog terminals

The field multiplexer supply U_{MUX} (24 V) generates the communications power U_L (7.5 V) and the analog supply U_{ANA} (24 V).

Communications power (U_L) and analog supply (U_{ANA})

Communications power (potential jumpers)

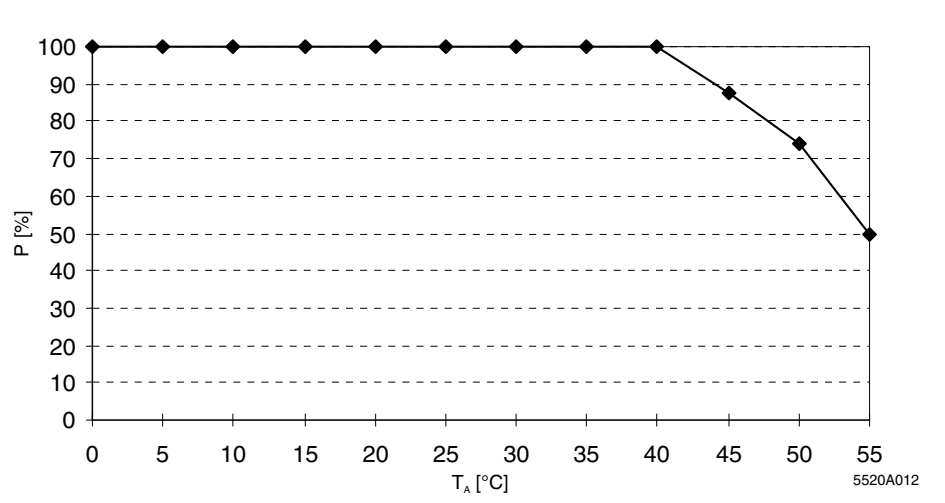
Nominal value	7.5 V DC
Maximum output current	2 A DC (observe derating)
Safety equipment	Electronic short-circuit protection

Analog supply (potential jumpers)

Nominal value	24 V DC
Maximum output current	0.5 A DC (observe derating)
Safety equipment	Electrical short-circuit protection

Derating of the communications power and the analog terminal supply

- I/O supply with a current carrying capacity of the bus coupler of 8 A, maximum



P [%]	Current carrying capacity of the communications power (U_L) and the analog supply (U_{ANA}) in %
T_A [°C]	Ambient temperature in °C

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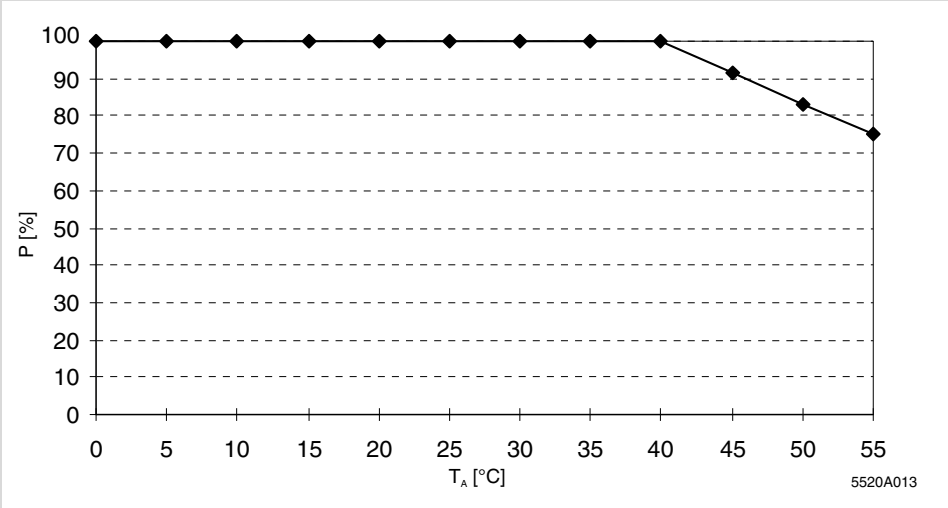
Derating of the communications power and the analog terminal supply

- I/O supply with a current carrying capacity at the bus coupler of 4 A, maximum



P [%]	Current carrying capacity of the communications power (U_L) and the analog supply (U_{ANA}) in %
T_A [°C]	Ambient temperature in °C

Protective equipment

Surge voltage (segment supply U_S/main supply U_M/ field multiplexer supply U_{MUX})	Input protective diodes (can be destroyed by permanent overload) Pulse loads up to 1500 W are short circuited by the input protective diode.
Polarity reversal (segment supply U_S/main supply U_M)	Parallel diodes for protection against polarity reversal; in the event of an error the high current through the diodes causes the preconnected fuse to blow.
Polarity reversal (field multiplexer supply U_{MUX})	Serial diode in the lead path of the power supply; in the event of an error only a low current flows. In the event of an error, no fuse trips within the external power supply. Ensure 2 A fuse protection to the external power supply.

The field multiplexer supply is protected against polarity reversal and surge voltage. These protective elements are only used to protect the power supply unit.

Electrical isolation

RS-485 interface/supply voltage	500 V AC, 1 min.
RS-485 interface/local bus	500 V AC, 1 min.

Interfaces

Remote bus	
Connection	Inline shield connector
Interface type	RS-485, modified
Transmission protocol	Special remote control protocol
Remote bus length (copper)	12 km, maximum and 5 km, typical (depending on cable type and EMC environmental conditions)
Remote bus length (fiber optic)	Using fiber optic converters
– Polymer fiber	Up to 100 m
– HCS fiber	Up to 2400 m
– Multi-mode glass fiber	Up to 25 km
– Single-mode glass fiber	Up to 45 km
Local bus	
Connection	Inline data routing

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Local functions

Alarm output (floating contacts)	N/C relay contact for 24 V DC/1 A, typical Maximum contact power: 30 W DC or 60 VA AC Maximum contact voltages: 150 V DC or 125 V AC (A maximum switching current of 1 A must not be exceeded)

Observe high inrush currents when using lamps as alarm signals. Phoenix Contact recommends avoiding lamp loads greater than 24 V/40 mA.

Mechanical requirements

Vibration (operation)	2g, according to IEC 60068-2-6, criterion 1
Vibration (storage)	2g, according to IEC 60068-2-6
Shock (operation)	15g, according to IEC 60068-2-27, criterion 2

Conformance with EMC directive 2004/108/EC

Noise immunity test according to DIN EN 61000-6-2

Electrostatic discharge (ESD)	EN 61000-4-2/ IEC 61000-4-2	Criterion B 6 kV contact discharge 8 kV air discharge
Electromagnetic fields	EN 61000-4-3 IEC 61000-4-3	Criterion A Field strength: 10 V/m
Fast transients (burst)	EN 61000-4-4/ IEC 61000-4-4	Criterion A All interfaces: 1 kV
Surge voltage	EN 61000-4-5/ IEC 61000-4-5	Criterion B DC supply lines: 0.5 kV/0.5 kV (symmetrical/asymmetrical) Signal cables: 1.0 kV/2.0 kV (symmetrical/asymmetrical)
Conducted interference	EN 61000-4-6 IEC 61000-4-6	Criterion A Test voltage 10 V

Noise emission test according to EN 61000-6-4

Noise emission of housing	EN 55011	Class A

Approvals

For the latest approvals, please visit www.download.phoenixcontact.com or www.eshop.phoenixcontact.com.

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4 Connection

An end plate is provided with the field multiplexer. Place this plate at the end of the field multiplexer station. The end plate has no electrical function. It protects the station from ESD pulses and the user from dangerous contact voltage.

5 Local diagnostic indicators

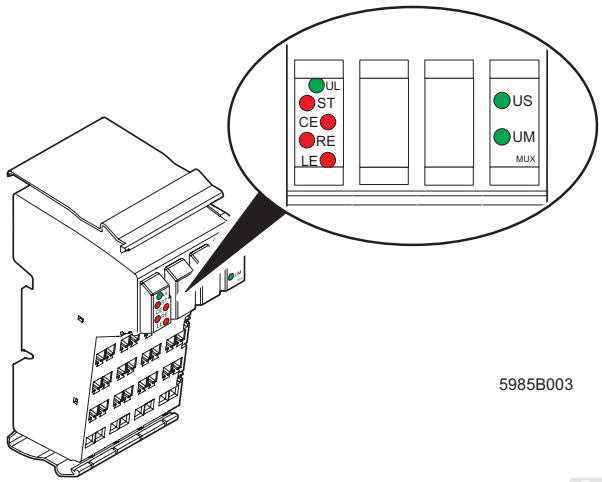

Figure 1 Diagnostic indicators of the field multiplexer

Des.	Color	Meaning
UL	Green	24 V field multiplexer supply/ 7.5 V communications power/ interface supply
ST	Red	Field multiplexer stopped
CE	Red	Configuration error
RE	Red	Remote bus error
LE	Red	Local bus error
US	Green	24 V segment supply
UM	Green	24 V main supply

6 Terminal point assignment

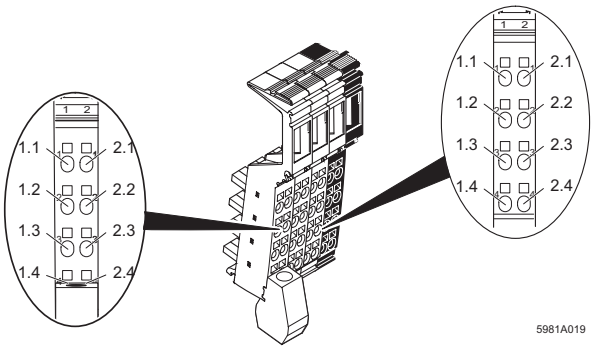

Figure 2 Terminal point assignment

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Terminal point	Assignment	Remark
Connector 1	**Remote bus, configuration of transmission mode (copper/fiber optics)**	
1.1, 2.1	$CONF_{FO}$	Configuration of transmission mode (copper/fiber optics)
1.2	DATA	Differential signal, data line to the opposite station (remote bus)
2.2	/DATA	Differential signal, data line to the opposite station (remote bus)
1.3, 2.3	GND_{DATA}	Reference potential for DATA and /DATA
1.4, 2.4	Shield	Shield potential of the data line (remote bus)
Connector 2	**No function**	
		Cover for unused terminal points
Connector 3	**Floating alarm contact, U_{MUX} supply, master/slave configuration**	
1.1	Alarm_IN	Alarm contact (floating, closed in the event of an error)
2.1	Alarm_OUT	Alarm contact (floating, closed in the event of an error)
1.2, 2.2	U_{MUX}	Field multiplexer supply (24 V DC)
1.3, 2.3	GND_{MUX}	GND for field multiplexer supply The potential is reference ground for the field multiplexer electronics
1.4, 2.4	$CONF_{MA}$	Master/slave configuration
Connector 4	**Power connector (U_M / U_S)**	
1.1, 2.1	U_S	24 V segment supply; the supplied voltage is directly routed to the potential jumper.
1.2, 2.2	U_M	24 V main supply; the supplied voltage is directly led to the potential jumper.
1.3, 2.3	GND	The reference potential is directly led to the potential jumper and is, at the same time, reference ground for the main and segment supply.
1.4, 2.4	FE	Connection of the field multiplexer, i.e., of the field multiplexer station to functional earth ground. The contacts are directly connected to the potential jumper and the FE spring on the bottom of the housing. Functional earth ground is only used to discharge interference.

Contacts with identical designations are electrically connected inside the field multiplexer.

For information on the power supplies, please refer to the IL SYS INST UM E user manual.

NOTE: Overload

The maximum total current through the potential jumpers U_M and U_S is 8 A.

NOTE: Malfunction

Connect the field multiplexer to functional earth ground via the FE connection of connector 4. For this, connect the corresponding contact with a grounding terminal (see also Figure 3 on page 10).

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7 Notes on using the terminal in potentially explosive areas

Approval according to directive 94/9/EC

Ⓔx II 3 G Ex nAC IIC T4 X

Installation notes

– This Inline terminal can be installed in zone 2.

1. The Inline terminal must only be installed, operated, and maintained by qualified personnel.
2. Please follow the installation instructions given in the IL SYS INST UM E user manual and the package slip.
3. Observe all applicable safety directives (even national safety regulations), accident prevention regulations, as well as general rules of technology when installing and operating the equipment.
4. Please refer to the corresponding documentation (user manual, data sheet, package slip) and the certificates (EC type examination and other approvals, if applicable) for safety-related data.
5. It is not permitted to access the circuits inside the Inline terminal. Do not repair the Inline terminal by yourself but replace it with a terminal of the same type. Repairs may only be carried out by the manufacturer.
6. IP20 (EN 60529) protection of the device is provided for a clean and dry environment.
7. Do not subject the Inline terminal to mechanical strain and thermal loads, which exceed the limits specified in the product documentation.
8. The Inline terminal has not been designed for use in dust potentially explosive atmospheres.

Installation in zone 2

1. Observe the specified conditions for use in potentially explosive areas.
2. When installing the terminal, use an appropriate and approved housing with a minimum protection of IP54. Please observe the EN 60079-14 requirements, e.g., a steel housing with a wall thickness of 3 mm.
3. In potentially explosive areas, only snap the Inline terminal onto the rail and connect the cables when the power is switched off.
4. In zone 2, only connect devices to the supply and signal circuits that are suitable for operation in potentially explosive areas of zone 2 and the conditions at the installation location.

Restrictions/limit values

1. **Only Inline terminals that are approved for use in potentially explosive areas may be snapped next to this Inline terminal.**
   Before using an Inline terminal in a zone 2 potentially explosive area, first check that the terminal has been approved for installation in this area.
   For a list of terminals approved for use in zone 2 potentially explosive areas, please refer to the AH EN IL EX ZONE 2 application note.
2. Please ensure that the **supplies of U_M and U_S** at the field multiplexer do not exceed **4 A**.
3. Please make sure that the **maximum permissible current of 4 A** flowing through potential jumpers U_M and U_S (total current) is not exceeded when using the Inline terminals in potentially explosive areas.
4. Also ensure that the **maximum permissible current of 2 A** flowing through potential jumper U_L is not exceeded.
5. The maximum permissible current for each tension spring contact is 2 A.

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8 Configuration

8.1 Configure the"fiber optics" transmission mode

If you want to implement fiber optic data transmission, insert a cable jumper at connector 1 from 1.1 to 2.1 ($CONF_{FO}$) (see Figure 3 on page 10).

NOTE: Malfunction

Ensure that the same transmission mode (copper/fiber optic) is always set on the field multiplexer station and the opposite station.

8.2 Master/slave configuration

One field multiplexer station **must** be configured as the master. To do this, insert a cable jumper at connector 3 from 1.4 to 2.4 ($CONF_{MA}$) (see Figure 3 on page 10).

The **second** station **must** be configured as a slave. It must not have a cable jumper from 1.4 to 2.4. at connector 3.

8.3 Alarm contact

The field multiplexer has **a floating** alarm output (Alarm_IN and Alarm_OUT contacts at connector 3) that allows to indicate operating errors remotely. The contact is normally open, but it is closed in the event of an error and when the field multiplexer power supply fails.

Please refer to Section 3 "Technical data" for information on the alarm contact rating.

8.4 Connecting the remote bus cable

For interference-free transmission, Phoenix Contact recommends that you use a shielded cable. In this case, connector 1 of both stations should be connected to the DATA, /DATA, and GND_{DATA} signals and the shield (see also Figure 3 on page 10). In addition, the cables for DATA and /DATA must be twisted-pair cables.

9 Connection example

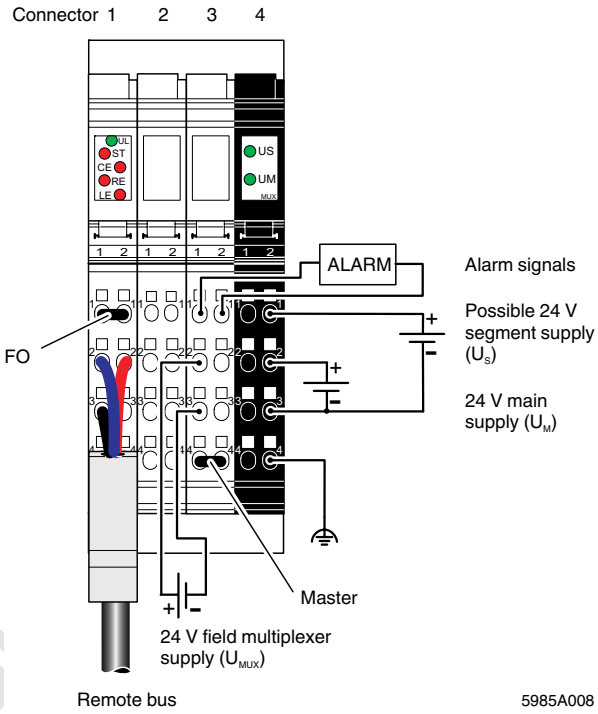

Figure 3 Typical connection of the cables to the field multiplexer

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10 Electrical isolation in the field multiplexer

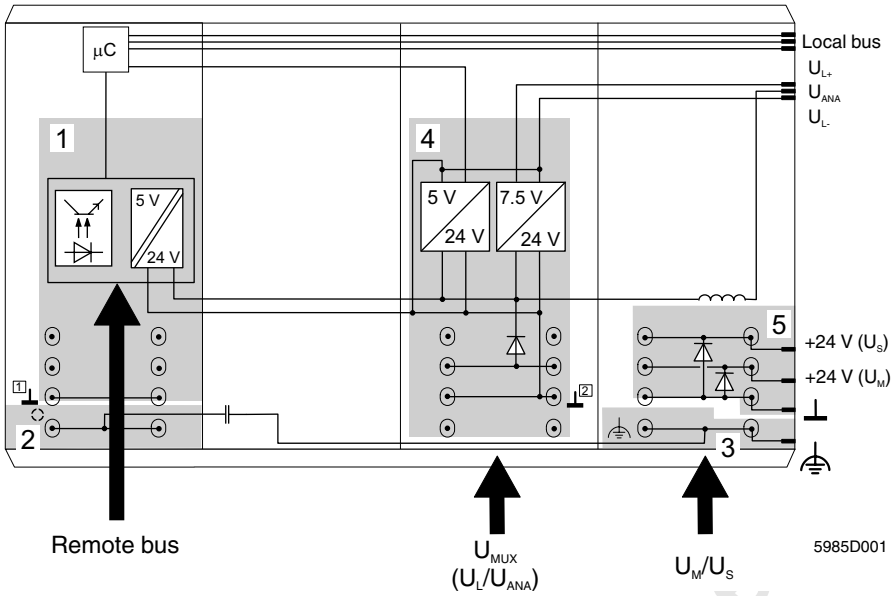

Figure 4 Electrical isolation of the individual function areas (separate power supply units)

Potential areas when using separate power supply units to supply U_{MUX} and U_M/U_S:

1 Area of remote bus cable
2 Area of functional earth ground (FE) capacitive for shield
3 Area of functional earth ground (FE)
4 Area of the field multiplexer supply U_{MUX} from which the communications power U_L and the supply for the analog terminals U_{ANA} are generated
5 Area of the I/O voltages U_M and U_S

Symbols used:

µC	Microcontroller		Converter
	Optocoupler	1	Reference potential GND_{DATA} (remote bus cable)
	Electrically isolated area	2	Reference potential GND_{MUX} (field multiplexer supply)
	Supply unit with electrical isolation		Shield potential; connected with a capacitor to FE of the potential jumper

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11 Complementary structure of a field multiplexer system

Field multiplexer stations must be created in such a way that each input terminal is assigned to an output module on the opposite side, and vice versa (complementary arrangement).

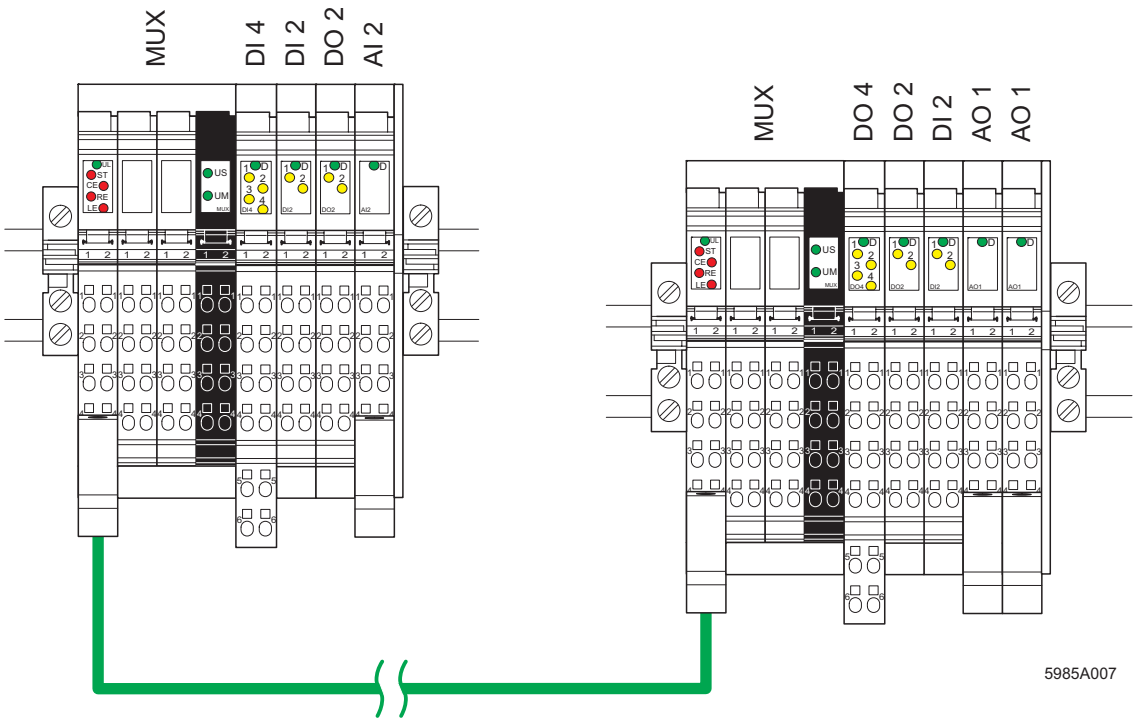

Figure 5 Typical structure of a field multiplexer system

CAUTION: Malfunction

Terminals for analog signals **must** always be installed to the right of the digital terminals in a field multiplexer station. If this rule is not observed, the field multiplexer station will report a configuration error, and the field multiplexer system will not be ready-to-operate. In the event of subsequent extension, digital terminals must be inserted before the analog terminals.

You will find a list of I/O terminals that can be operated in the AH IL BK IO LIST application note. Terminal combinations other than the ones listed in the table below are not permitted and will be detected as a configuration error. The IB IL AI 2/SF-PAC analog terminal can also be combined with two IB IL AO 1... terminals, see also "Possible combinations of analog I/O terminals" on page 14.

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The following matrix shows the possible combinations for a complementary terminal arrangement:

Outputs / Inputs	IB IL 24 PWR IN/F-D-PAC	IB IL 24 PWR IN/2-F-D-PAC	IB IL 24 SEG/F-D-PAC	IB IL 120 DI 1-PAC	IB IL 230 DI 1-PAC	IB IL 24 DI 2-PAC	IB IL 24 DI 2-NPN-PAC	IB IL 24 DI 4-PAC	IB IL 24 DI 8-PAC	IB IL 24 DI 8 T2-PAC	IB IL 24 DI 16-PAC	IB IL 24 DI 32/HD-PAC	IB IL AI 2/SF-PAC	IB IL AI 2/SF-230-PAC	IB IL 24 SAFE 1-PAC
IB IL DO 1 AC-PAC	(1)+	(1)+	(1)+	1	1	1	1	–	–	–	–	–	–	–	–
IB IL 24 DO 2-PAC	2	2	2	1	1	2	2	–	–	–	–	–	–	–	2
IB IL 24 DO 2-2A-PAC	2	2	2	1	1	2	2	–	–	–	–	–	–	–	2
IB IL 24 DO 2-2A-NPN-PAC	2	2	2	1	1	2	2	–	–	–	–	–	–	–	2
IB IL 24 DO 4-PAC	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–
IB IL 24 DO 8-PAC	–	–	–	–	–	–	–	–	8	8	–	–	–	–	–
IB IL 24 DO 8-2A-PAC	–	–	–	–	–	–	–	–	8	8	–	–	–	–	–
IB IL 24 DO 16-PAC	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–
IB IL 24 DO 32/HD-PAC	–	–	–	–	–	–	–	–	–	–	–	32	–	–	–
IB IL 24/230 DOR 1/W-PAC	(1)+	(1)+	(1)+	1	1	1	1	–	–	–	–	–	–	–	–
IB IL 24/230 DOR 1/W-PC-PAC	(1)+	(1)+	(1)+	1	1	1	1	–	–	–	–	–	–	–	–
IB IL 24/230 DOR 4/W-PAC	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–
IB IL 24/230 DOR 4/W-PC-PAC	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–
2 x IB IL AO 1/SF-PAC	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–
2 x IB IL AO 1/U/SF-PAC	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–
1 x IB IL AO 1/SF -PAC 1 x IB IL AO 1/U/SF-PAC	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–
1 x IB IL AO 2/U/BP-PAC	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–

Key for the table:

1, 2, 4, 8, 16, 32	Number of available channels
–	Combination not possible
+	Should be operated with the IB IL 24 DO 2-PAC terminal, as only the fuse and not the main power is monitored.

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Possible combinations of analog I/O terminals

Terminal	Signal	IB IL AO 1/ SF-PAC 0 V ... 10 V	IB ILAO 1/SF-PAC 0 mA ... 20 mA	IB IL AO 1/U/ SF-PAC 0 V ... 10 V	IB ILAO 2/UBP-PAC 0 V ... 10 V	IB IL AO 2/UBP-PAC -10 V ... +10 V
IB IL AI 2/ SF-PAC	-10 V ... +10 V					x
IB IL AI 2/ SF-PAC	0 V ... 10 V	x		x	x	
IB IL AI 2/ SF-PAC	4 mA ... 20 mA		x			
IB IL AI 2/ SF-PAC	0 mA ... 20 mA		x			

12 Transmission time

The maximum time required for data transmission depends on the type of transmission medium that has been selected and is usually within the following limits:

t_{Cu} = 80 ms to 500 ms

t_{FO} = 10 ms to 100 ms

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